The creation of two-dimensional electron gases in SrTiO3-based complex oxide heterostructures by interface redox reactions

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the extra control offered by the use of superlattices allows for careful tuning of the functional properties.

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P.36	**The creation of two-dimensional electron gases in $SrTiO_3$-based complex oxide heterostructures by interface redox reactions** Yunzhong Chen, Felix Trier, Dennis Christensen, and Nini Pryds *Department of Energy Conversion and Storage, Technical University of Denmark, Risø Campus, 4000 Roskilde, Denmark*

The conductance of strongly correlated transition metal 3*d* electrons confined at the interface of complex oxide heterostructures provides new opportunities to explore nanoelectronic devices. In particular, high-mobility two-dimensional electron gases (2DEGs) can be obtained at the interface between two oxide insulators, such as the intensively explored $LaAlO_3/SrTiO_3$ (LAO/STO) heterointerface. The mechanism for such high interface conductivity has been explained by polar discontinuity. Alternatively, when building heterostructures on STO, the basis material for oxide electronics, the conductance may originate from redox reactions at the interface, where free carriers are created when STO is reduced by the formation of oxygen vacancies.

In this presentation, we will revisit various metallic and insulating STO-based oxide heterostructures reported so far. The mechanism of the interface conductance in these STO-based oxide heterostructures will be discussed. Moreover, our current exploration of new 2DEGs in STO-based oxide heterostructures, relying on interface redox reactions, will be also present.

P.37	**Domain engineering in strained $BiFeO_3$ thin films grown on highly miscut $LaAlO_3$ substrates** C. Beekman[1], W. Siemons[1], T.Z. Ward[1], A.Y. Borisevich[1], J.D. Budai[1], and H.M. Christen[1], J.Z. Tischler[2] *[1]Materials Science & Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, [2]Advanced Photon Source, Argonne National Laboratory, Argonne, IL 60439, USA*

Much like epitaxial strain, substrate miscut is a tool for domain engineering in multiferroic thin films, and is shown here to have a profound effect on highly-strained epitaxial films of $BiFeO_3$ (BFO) on $LaAlO_3$ (LAO) (i.e. "T-like" BFO [1,2]). In fact, the response of T-like BFO to such a substrate miscut is strikingly different from that of other similar perovskite systems. For $PbTiO_3$ (PTO), for example, where strain relaxation results in mixed c- and a-domain films, $SrTiO_3$ (STO) substrate miscut results in modification of a-domains alignment [3]. Similarly, a reduced number of domain variants is observed in the case of BFO films on miscut STO substrates [4]. Here we present a comparative study of T-like BFO films grown on [001]-oriented LAO substrates with a miscut from 0° ("exact") to 4°, and grown by pulsed laser deposition. Atomic force microscopy (AFM) and RSM data for BFO on exact LAO show the typical mixed phase morphology with a striped phase embedded within the monoclinic multidomain T-like phase [5]. Confirming previous reports [6], we find that the striped-phase becomes more abundant as the film thickness is increased. However, a striking observation is that for films grown on the highly miscut substrates the striped-